

Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

Listing of Claims

1 1. (Original) A method of processing a plurality of keep-alive messages generated by  
2 a corresponding plurality of end systems, each of said plurality of keep-alive messages being  
3 designed to request the status of a corresponding point to point (PPP) session implemented  
4 on a communication network, said method comprising:

5 receiving in an aggregation device said plurality of keep-alive messages;

6 generating in said aggregation device an aggregated request packet which indicates  
7 that the status of said PPP sessions is requested; and

8 sending said aggregated request packet on said communication network to a peer  
9 aggregation device.

1 2. (Original) The method of claim 1, further comprising:

2 receiving said aggregated request packet in said peer aggregation device;

3 indicating the status of said plurality of sessions in an aggregated reply packet; and

4 sending said aggregated reply packet to said aggregation device.

1 3. (Original) The method of claim 1, further comprising receiving in said aggregation  
2 device an aggregated reply packet from said peer aggregation device, wherein said aggregated  
3 reply packet indicates the status of at least some of said plurality of PPP sessions.

1 4. (Presently Amended) The method of claim 3, further comprising sending from said  
2 aggregation device a proxy keep-alive reply message to one of said plurality of end systems  
3 originating a corresponding one of said keep alive-messages without waiting for said  
4 aggregated reply packet.

1 5. (Original) The method of claim 4, further comprising:

2 maintaining a remote status table in said aggregation device, wherein said remote  
3 status table indicates the status of sessions supported by said aggregation device;

4 updating said remote status table with the information in said aggregated reply packet;

5 and

Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

6 generating said proxy keep-alive reply according to said remote status table.

1 6. (Original) The method of claim 5, wherein said proxy keep-alive message indicates  
2 that the corresponding session is alive/OK when a first keep-alive message is received for the  
3 corresponding session.

1 7. (Original) The method of claim 6, further comprising initializing the status of each  
2 of said session to alive/OK such that said proxy keep-alive message in response to said first  
3 keep-alive message indicates alive/OK status.

1 8. (Original) The method of claim 1, wherein said communication network is  
2 implemented using one of frame relay, ATM and IP networks.

1 9. (Original) The method of claim 1, wherein said aggregation device is one of a  
2 network access server and home gateway.

1 10. (Original) A method of processing an aggregated request packet in an aggregation  
2 device, wherein said aggregated request packet indicates that the status of a plurality of point-  
3 to-point sessions are requested, said method comprising:  
4 examining said aggregated request packet to determine said plurality of point-to-point  
5 sessions;  
6 determining the status of each of said plurality of point-to-point sessions;  
7 generating an aggregated reply packet indicating the status of said plurality of point-to-  
8 point sessions; and  
9 sending said aggregated reply packet to said peer aggregation device.

1 11. (Original) The method of claim 10, wherein said determining comprises accessing  
2 a local status table which contains the status information of at least some of said plurality of  
3 point-to-point sessions.

Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

1           12. (Original) The method of claim 10, wherein said generating comprises including  
2 a client magic number associated with each of said plurality of point-to-point sessions.

1           13. (Original) The method of claim 10, wherein said generating comprises setting a  
2 bit to one logical value to indicate that a corresponding one of said plurality of sessions is  
3 OK/alive, and to another logical value to indicate that said corresponding one of said plurality  
4 of session not OK/alive.

1           14. (Original) The method of claim 10, wherein said aggregation device comprises  
2 one of a network access server (NAS) and a home gateway implemented in a communication  
3 network.

1           15. (Original) An aggregation device for processing a plurality of keep-alive messages  
2 generated by a corresponding plurality of end systems, each of said plurality of keep-alive  
3 messages being designed to request the status of a corresponding point to point (PPP) session  
4 implemented on a communication network, said aggregation device comprising:

5           an input interface receiving said plurality of keep-alive messages;

6           a message aggregator coupled to said input interface, said message aggregator  
7 examining said plurality of message and generating data according to a format indicating that  
8 the status of said PPP sessions is requested; and

9           an output interface sending an aggregated request packet on said communication  
10 network to a peer aggregation device, said aggregated request packet containing said data  
11 generated by said message aggregator.

1           16. (Original) The aggregation device of claim 15, further comprising an encapsulator  
2 encapsulating said data in a packet suitable for transmission on said communication network.

1           17. (Original) The aggregation device of claim 16, further comprising:

2           a remote status table indicating the status of sessions supported by said aggregation  
3 device; and

Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

4 a de-aggregator receiving an aggregated reply packet from said peer aggregation  
5 device, wherein said aggregated reply packet indicates the status of at least some of said  
6 plurality of PPP sessions, said de-aggregator updating said remote status table with the  
7 information in said aggregated reply packet.

1 18. (Original) The aggregation device of claim 17, further comprising a proxy reply  
2 unit sending a proxy keep-alive reply message to one of said plurality of end systems  
3 originating a corresponding one of said keep alive-messages without waiting for said  
4 aggregated reply packet.

1 19. (Original) The invention of claim 18, wherein said aggregation device comprises  
2 a network access server.

1 20. (Original) The aggregation device of claim 18, wherein said aggregated request  
2 packet contains a magic number related to each of the corresponding sessions.

1 21. (Original) An aggregation device for processing a plurality of keep-alive messages  
2 generated by a corresponding plurality of end systems, each of said plurality of keep-alive  
3 messages being designed to request the status of a corresponding point to point (PPP) session  
4 implemented on a communication network, said aggregation device comprising:

5 first means for receiving said plurality of keep-alive messages;  
6 means for generating an aggregated request packet which indicates that the status of  
7 said PPP sessions is requested; and  
8 means for sending said aggregated request packet on said communication network to  
9 a peer aggregation device.

1 22. (Original) The aggregation device of claim 21, further comprising second means  
2 for receiving an aggregated reply packet from said peer aggregation device, wherein said  
3 aggregated reply packet indicates the status of at least some of said plurality of PPP sessions.

Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

1           23. (Original) The aggregation device of claim 22, further comprising means for  
2 sending a proxy keep-alive reply message to one of said plurality of end systems originating  
3 a corresponding one of said keep alive-messages without waiting for said aggregated reply  
4 packet.

1           24. (Original) The aggregation device of claim 23, further comprising:  
2 means for maintaining a remote status table in said aggregation device, wherein said  
3 remote status table indicates the status of sessions supported by said aggregation device;  
4 means for updating said remote status table with the information in said aggregated  
5 reply packet; and  
6 means for generating said proxy keep-alive reply according to said remote status table.

1           25. (Original) An aggregation device for processing an aggregated request packet,  
2 wherein said aggregated request packet indicates that the status of a plurality of point-to-point  
3 sessions are requested, said aggregation device comprising:  
4 means for examining said aggregated request packet to determine said plurality of  
5 point-to-point sessions;  
6 means for determining the status of each of said plurality of point-to-point sessions;  
7 means for generating an aggregated reply packet indicating the status of said plurality  
8 of point-to-point sessions; and  
9 means for sending said aggregated reply packet to said peer aggregation device.

1           26. (Original) The aggregation device of claim 25, wherein said means for  
2 determining comprises means for accessing a local status table which contains the status  
3 information of at least some of said plurality of point-to-point sessions.

1           27. (Original) The aggregation device of claim 25, wherein said means for generating  
2 includes a client magic number associated with each of said plurality of point-to-point  
3 sessions.

Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

1           28. (Original) The aggregation device of claim 25, wherein said means for generating  
2 sets a bit in said aggregated reply packet to one logical value to indicate that a corresponding  
3 one of said plurality of sessions is OK/alive, and to another logical value to indicate that said  
4 corresponding one of said plurality of session not OK/alive.

1           29. (Original) The aggregation device of claim 25, wherein said aggregation device  
2 comprises one of a network access server (NAS) and a home gateway implemented in a  
3 communication network.

1           30. (Original) An aggregation device for processing an aggregated request packet,  
2 wherein said aggregated request packet indicates that the status of a plurality of point-to-point  
3 sessions are requested, said aggregation device comprising:  
4           an input interface receiving said aggregated request packet;  
5           a de-encapsulator examining said aggregated request packet to determine that said  
6 aggregated request packet relates to requesting the status of point-to-point sessions;  
7           a reply generator determining the status of each of said plurality of point-to-point  
8 sessions, and generating an aggregated reply packet indicating the status of said plurality of  
9 point-to-point sessions; and  
10          an output interface sending said aggregated reply packet to said peer aggregation  
11 device.

1           31. (Original) The aggregation device of claim 30, further comprising a local status  
2 table storing the status information of at least some of said plurality of point-to-point sessions,  
3 wherein said reply generator determines the status of said at least some of said plurality of  
4 point-to-point sessions by accessing said local status table.

1           32. (Original) The aggregation device of claim 31, further comprising a session  
2 manager updating the status of said plurality of point-to-point sessions in said local status  
3 table.

Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

1           33. (Original) The aggregation device of claim 30, wherein said reply generator  
2 includes in said aggregated reply packet a client magic number associated with each of said  
3 plurality of point-to-point sessions.

1           34. (Original) The aggregation device of claim 30, wherein said reply generator sets  
2 a bit in said aggregated reply packet to one logical value to indicate that a corresponding one  
3 of said plurality of sessions is OK/alive, and to another logical value to indicate that said  
4 corresponding one of said plurality of session not OK/alive.

1           35. (Original) The aggregation device of claim 30, further comprising a keep-alive  
2 processor coupled to said de-encapsulator, wherein said keep-alive processor examines said  
3 aggregated request packet to determine that status of point-to-point sessions is requested and  
4 causes said reply generator to generate said aggregated reply packet.

1           36. (Original) The aggregation device of claim 30, wherein said aggregation device  
2 comprises one of a network access server (NAS) and a home gateway implemented in a  
3 communication network.

1           37. (Original) A computer-readable medium carrying one or more sequences of  
2 instructions for causing a aggregation device to process a plurality of keep-alive messages  
3 generated by a corresponding plurality of end systems, each of said plurality of keep-alive  
4 messages being designed to request the status of a corresponding point to point (PPP) session  
5 implemented on a communication network, wherein execution of said one or more sequences  
6 of instructions by one or more processors contained in said aggregation device causes said one  
7 or more processors to perform the actions of:

8           receiving in an aggregation device said plurality of keep-alive messages;

9           generating in said aggregation device an aggregated request packet which indicates  
10 that the status of said PPP sessions is requested; and

11           sending said aggregated request packet on said communication network to a peer  
12 aggregation device.

Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

1 38. (Original) The computer-readable medium of claim 37, further comprising:  
2 receiving said aggregated request packet in said peer aggregation device;  
3 indicating the status of said plurality of sessions in an aggregated reply packet; and  
4 sending said aggregated reply packet to said aggregation device.

1 39. (Original) The computer-readable medium of claim 37, further comprising  
2 receiving in said aggregation device an aggregated reply packet from said peer aggregation  
3 device, wherein said aggregated reply packet indicates the status of at least some of said  
4 plurality of PPP sessions.

1 40. (Original) The computer-readable medium of claim 39, further comprising sending  
2 a proxy keep-alive reply message to one of said plurality of end systems originating a  
3 corresponding one of said keep alive-messages without waiting for said aggregated reply  
4 packet.

1 41. (Original) The computer-readable medium of claim 40, further comprising:  
2 maintaining a remote status table in said aggregation device, wherein said remote  
3 status table indicates the status of sessions supported by said aggregation device;  
4 updating said remote status table with the information in said aggregated reply packet;  
5 and  
6 generating said proxy keep-alive reply according to said remote status table.

1 42. (Original) A computer-readable medium carrying one or more sequences of  
2 instructions for causing an aggregation device to process an aggregated request packet,  
3 wherein said aggregated request packet indicates that the status of a plurality of point-to-point  
4 sessions are requested, wherein execution of said one or more sequences of instructions by  
5 one or more processors contained in said aggregation device causes said one or more  
6 processors to perform the actions of:



Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

7           examining said aggregated request packet to determine said plurality of point-to-point  
8      sessions;  
9           determining the status of each of said plurality of point-to-point sessions;  
10          generating an aggregated reply packet indicating the status of said plurality of point-to-  
11      point sessions; and  
12          sending said aggregated reply packet to said peer aggregation device.

1           43. (Original) The computer-readable medium of claim 42, wherein said determining  
2      comprises accessing a local status table which contains the status information of at least some  
3      of said plurality of point-to-point sessions.

1           44. (Original) The computer-readable medium of claim 42, wherein said generating  
2      comprises including a client magic number associated with each of said plurality of point-to-  
3      point sessions.

1           45. (Original) The computer-readable medium of claim 42, wherein said generating  
2      comprises setting a bit to one logical value to indicate that a corresponding one of said  
3      plurality of sessions is OK/alive, and to another logical value to indicate that said  
4      corresponding one of said plurality of session not OK/alive.

1           46. (Original) The computer-readable medium of claim 42, wherein said aggregation  
2      device comprises one of a network access server (NAS) and a home gateway implemented in  
3      a communication network.

1           47. (Original) A communication network comprising:  
2      a first aggregation device receiving a plurality of keep-alive messages generated by a  
3      corresponding plurality of end systems, each of said plurality of keep-alive messages being  
4      designed to request the status of a corresponding point to point (PPP) session implemented  
5      on said communication network, said first aggregation device generating an aggregated

Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

6 request packet which indicates that the status of said PPP sessions is requested, and sending  
7 said aggregated request packet; and  
8 a peer aggregation device receiving said aggregated request packet and indicating the  
9 status of said plurality of sessions in an aggregated reply packet, said peer aggregation packet  
10 sending said aggregated reply packet to said first aggregation device.

1 48. (Original) The communication network of claim 47, wherein said first aggregation  
2 device is located at an edge of said communication networks.

1 49. (Original) The communication network of claim 48, further comprising an access  
2 network coupling said first aggregation device to said corresponding plurality of end systems,  
3 wherein said plurality of keep-alive messages are received on said access network.

1 50. (Original) The communication network of claim 49, wherein said first aggregation  
2 device and said peer aggregation device respectively comprise a network access server (NAS)  
3 and a home gateway.

1 51. (New) The method of claim 1, wherein said aggregation device is in the path of  
2 all of said plurality of PPP sessions.

1 52. (New) The method of claim 10, wherein said aggregation device is in the path of  
2 all of said plurality of PPP sessions.

1 53. (New) The invention of claim 15, wherein said aggregation device is in the path  
2 of all of said plurality of PPP sessions.

1 54. (New) The invention of claim 21, wherein said aggregation device is in the path  
2 of all of said plurality of PPP sessions.

Reply to Office Action of June 23, 2004  
Amendment Dated: September 13, 2004

Appl. No.: 09/785,884  
Attorney Docket No.: CSCO-002/94701

1           55. (New) The invention of claim 25, wherein said aggregation device is in the path  
2           of all of said plurality of PPP sessions.

1           56. (New) The invention of claim 30, wherein said aggregation device is in the path  
2           of all of said plurality of PPP sessions.

1           57. (New) The computer readable medium claim 37, wherein said aggregation device  
2           is in the path of all of said plurality of PPP sessions.

1           58. (New) The computer readable medium claim 42, wherein said aggregation device  
2           is in the path of all of said plurality of PPP sessions.